REMARKS

Responsive to the Office Action dated July 17, 2003, Applicant hereby makes the following response. The present application was filed on August 17, 2001 and included Claims 1-6 of which Claims 1 and 4 are independent. Applicant has added new Claims 7-26 and has cancelled Claims 2 and 3. Accordingly, Claims 1-26 are pending for prosecution with Claims 1 and 4 being independent.

I. Summary of the Claims

The present invention is concerned with a non-aqueous electrolyte secondary cell. Traditional lead-acid cell and nickel-cadmium cells have low discharge voltage, low energy density, and more self-discharge than lithium-based secondary cells. Lithium-based secondary cells also show excellent cycle characteristics. These secondary cells may be used as an operating power supply for portable electronic devices which are often used for long periods of time. Moreover, lithium-based secondary cells may also function as a power supply for small electronic devices that require long-period charge/discharge cycle characteristics. However, prior art lithium-based secondary cells are typically limited in usability for long periods of time and are sensitive to storage environment conditions, particularly high temperature environments. The present invention therefore discloses a non-aqueous electrolyte secondary cell using $Li_xFe_yPO_4$, wherein $0 \leq x \leq 2$ and $1 \leq y \leq 2$. The secondary cell of the present invention provides a high capacity power supply and exhibits superior storage characteristics even when stored in a high temperature environment for long periods of time.

Independent Claim 1 recites a non-aqueous electrolyte secondary cell comprising a cathode which comprises $Li_xFe_yPO_4$ wherein $0 < x \leq 2$ and $1 \leq y \leq 2$. The cell also includes an

anode comprising sintered carbon material prepared by sintering a carbon a material capable of doping/dedoping lithium, and a non-aqueous electrolyte solution.

Independent Claim 4 recites a non-aqueous electrolyte secondary cell comprising a cathode which comprises $Li_xFe_yPO_4$ wherein $0 \leq x \leq 2$ and $1 \leq y \leq 2$. The cathode is a molded body comprising an active material and a conductive agent. An anode is also included which is capable of doping/dedoping lithium. The anode is a molded body comprising a material selected from the group consisting of an active material, a conductive agent, and mixtures thereof. The secondary cell also includes a non-aqueous electrolyte solution.

II. The Disclosure Objections

The Examiner has objected to the specification because the specification states that, in the formula $A_xM_yPO_4$, M represents a transition metal and preferably includes at least one of Co, Ni, Fe, Mn, Cu, Mg, Zn, Ca, Cd, Sr and Ba. However, because Mg, Ca, Sr and Ba are considered alkaline-earth metals, the Examiner has required appropriate correction of the specification. Accordingly, Applicant has so amended its specification and respectfully requests entry of the amendment and withdrawal of this objection.

III. The Claim Objections

The Examiner has objected to Claims 2 and 6 for reciting M as a transition metal only and for containing improper Markush group language. Applicant has cancelled claim 2 and has deleted the objectionable language from Claim 6. Applicant therefore respectfully requests withdrawal of these objections.

IV. The § 112 Rejections

Claims 4-6 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point and distinctly claim the subject matter which applicant regards as the invention. In view of the Examiner's suggestions, Applicant has amended its claims to

overcome the indefiniteness cited by the Examiner and has also deleted the parentheses in Claims 1 and 4. Accordingly, Applicant respectfully requests withdrawal of this rejection.

V. The § 103(a) Rejections

A. Rejection of Claims 1, 2 and 4-6 over Kamauchi in view of Moriguchi

Claims 1, 2 and 4-6 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,705,296 to Kamauchi et al., in view of U.S. Patent No. 6,576,369 to Moriguchi et al. For the following reasons, Applicant respectfully submits that the present invention is not obvious under 35 U.S.C. § 103(a) and requests reconsideration and withdrawal of this rejection.

To establish a prima facie case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

With respect to objective evidence of nonobviousness, Applicant submits that the record supports the conclusion that there are long-felt but unsolved needs met by the present invention. The present invention is directed to the particular problem of providing a new and improved lithium-based secondary cell which is capable of use over long periods of time in addition to surviving high temperature storage over long periods of time while still maintaining high discharge voltage, high energy density, less self-discharge and excellent cycle characteristics.

Kamauchi does not teach or suggest the claimed invention. There is no teaching or

suggestion of a non-aqueous electrolyte secondary cell wherein the positive electrode is comprised of lithium iron phosphate. Kamauchi only teaches the use of lithium phosphate, lithium-cobalt phosphate, cobalt oxide, and lithium-cobalt oxide such that phosphorus is maintained at a concentration of 0.25 - 1.8 moles and cobalt at a concentration of 0.2-1.75 moles with respect to 1 molar lithium. Column 2, lines 57-63. The Office Action, at page 4, states that "[t]ransition metals besides cobalt such as Ni, Fe, Mn, Cr and V may be contained in the lithium-phosphate positive active material (col. 4, lines 42-44)." However, Kamauchi first requires that the positive electrode active material have a molar ratio of cobalt:phophorus:lithium equal to more than 0.1:more than 0.2:1 and the active material must comprise at least one member selected from the group of lithium phosphate, lithium-cobalt phosphate, cobalt oxide, and lithium-cobalt oxide so as to fulfill the required molar ratio. Column 4, lines 25-31. Kamauchi only discloses the addition of transition metals to the active material comprising one or more of lithium phosphate, lithium-cobalt phosphate, cobalt oxide, and lithium-cobalt oxide. In fact, Kamauchi teaches away from the present invention. Use of $Li_xFe_yPO_4$ as the active material would not fulfill Kamauchi's requirement that the active material have a molar ratio of cobalt:phophorus:lithium equal to more than 0.1:more than 0.2:1. Moreover, Kamauchi does not teach or suggest an active particle size of not greater than 10 μm and, more preferably, not greater than 1 μm. To the contrary, Kamauchi teaches an *average* particle size of 0.01-20 μm. Applicant's invention is not so limited. Finally, as stated in the Office Action at page 5, "Kamauchi does not explicitly teach the carbon negative electrode is a sintered carbon material."

Moriguchi also does not teach or suggest the present invention. Moriguchi merely discloses a lithium secondary battery having an anode comprising a graphite material. Moriguchi does not teach or suggest the use of $Li_xFe_yPO_4$ as a cathode active material in conjunction with an anode capable of doping/dedoping lithium and a non-aqueous electrolyte

solution. In fact, Moriguchi teaches away from the present invention. Moriguchi only discloses lithium-containing transition metal oxides as the positive electrode active material. There is no disclosure of or suggestion to use a phosphate as an active material.

Finally, prima facie obviousness requires that there must be a reasonable expectation of success when prior art is modified or combined. In the present application, there is no reasonable expectation of success in achieving the invention as claimed when the cited references are modified or combined. As discussed above, none of the cited references contain all the elements of Applicants' independent claims 1 and 4. Unless all the elements are taught by the references, there can be no success in modifying them.

Thus, at the time the present invention was made, neither Kamauchi nor Moriguchi teach or describe *all* of the limitations claimed by Applicant in independent claims 1 and 4 and the claims depending therefrom. It would therefore not have been obvious to one of ordinary skill in the art to provide a cathode active material comprising an active material including $Li_xFe_yPO_4$. Accordingly, independent claims 1 and 4 and the claims depending therefrom are nonobvious under § 103 (a).

B. Rejection of Claim 3 over Kamauchi in view of Moriguchi and Goodenough

Claim 3 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kamauchi in view of Moriguchi and further in view of U.S. Patent No. 5,910,382 to Goodenough et al. For the following reasons, Applicant respectfully requests reconsideration and withdrawal of this rejection.

As discussed above, neither Kamauchi nor Moriguchi teach or suggest the use of $Li_xFe_yPO_4$ as a cathode active material. Goodenough also does not teach or suggest the present invention. In particular, Goodenough does not teach or suggest an anode comprising sintered carbon material which is prepared by sintering a carbon material capable of doping/dedoping

lithium. Goodenough also does not teach or suggest an anode capable of doping/dedoping lithium where the anode is a molded body comprising an active material, a conductive agent or mixtures thereof. Moreover, there is no reasonable expectation of success in achieving the invention as claimed when the cited references are modified or combined. As discussed above, none of the cited references contain all the elements of Applicants' independent claims 1 and 4. Unless all the elements are taught by the references, there can be no success in modifying them.

Thus, at the time the present invention was made, none of the references cited teach or describe *all* of the limitations claimed by Applicant in independent claims 1 and 4 and the claims depending therefrom. It would therefore not have been obvious to one of ordinary skill in the art to provide a cathode active material comprising an active material including $Li_xFe_yPO_4$ and an anode capable of doping/dedoping lithium. Accordingly, independent claims 1 and 4 and the claims depending therefrom are nonobvious under § 103 (a).

VI. Conclusion

Applicant respectfully requests withdrawal of the rejections and believes that the claims as presented represent allowable subject matter. However, if the Examiner desires, the applicant is ready for a telephone interview to expedite prosecution. As always, the Examiner is free to call the undersigned at 816.460.2516. Should any fees be necessitated by this response, the Commissioner is hereby authorized to deduct any such fees from Deposit Account No. 19-3140.

Respectfully submitted,

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